# American Potato Journal

Published Monthly by

THE POTATO ASSOCIATION OF AMERICA

East Lansing, Michigan

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VOLUME VIII JUNE, 1931 NUMBER 6

C-O-N-T-E-N-T-S

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Entered as second class matter at East Lansing, Michigan, March 4, 1928, under Act of March 3, 1879.

Accepted for mailing at special rate of postage provided for in section 412, Act of February 28, 1925, authorized on March 14, 1928.

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# AMERICAN POTATO JOURNAL

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## The Effect of Different Pressures and of Different Types of Lime in Potato Spraying


PAUL E. TILFORD, Experiment Station, Wooster, Ohio


Not so many years ago potato growers were rather skeptical concerning spraying. It was considered by many as a practice which gave returns some years, but in other years was only a bother and added expense, which did not increase the yield materially. Today, however, all good growers in the northern and central states of the potato growing section of the country accept thorough spraying as a necessary essential of the potato growing program. Numerous experiments, demonstrations, and the good results obtained by farmers who spray have proven beyond a doubt that proper spraying is one of the most profitable practices used in growing potatoes.

Keeping the potato vines thoroughly covered with bordeaux mixture from the time the plants come through the ground until they are mature in the fall protects them from late blight, early blight, hopperburn, and the excessive heat during mid-summer. Spraying also decreases flea-beetle injury. In Ohio, where the experiments reported in this paper have been conducted, the benefits derived from spraying are largely due to controlling hopperburn, protecting the plants fom the heat, and to the insecticidal value of the bordeaux. Late blight rarely occurs in epidemic form and early blight is seldom serious.

Manufacturers have made rapid progress in perfecting potato spraying equipment during the past few years. Most of the large sprayers on the market today will apply the spray

under extremely high pressure—five or six hundred pounds. The question immediately arises as to what pressure is most effective. Even a large sprayer is under a much greater strain and as a result, wears faster and causes more trouble when operated at extremely high pressure than at a medium pressure. It is therefore desirable to know what pressure gives the best results. Experiments have been conducted at the Ohio Experiment Station, during the past two seasons, comparing the value of bordeaux mixture applied under 200, 400 and 600 pounds pressure. The results of these tests are given in Table 1.

TABLE 1.—Effect of bordeaux applied at different pressures on potato yields.

| Year and Treatment | Number of applications | Average yield bu. per acre | Increase due to spraying |
|---|---|---|---|
| **1929—** | | | |
| 4-6-50 (200 lbs. pressure) | 9 | 206.2 | 43.4 |
| 4-6-50 (400 lbs. pressure) | 9 | 226.1 | 63.3 |
| 4-6-50 (600 lbs. pressure) | 9 | 207.5 | 44.7 |
| No spray | ---- | 162.8 | ..... |
| **1930—** | | | |
| 4-6-50 (200 lbs. pressure) | 12 | 290.9 | 123.4 |
| 4-6-50 (400 lbs. pressure) | 12 | 293.0 | 125.5 |
| 4-6-50 (600 lbs. pressure) | 12 | 283.9 | 116.4 |
| No spray | ---- | 167.5 | ..... |

In both of these tests higher yields were obtained from the plots sprayed at 400 pounds pressure than at either 200 or 600. The amount of spray applied increases as the pressure increases and a pressure of 200 pounds does not put out enough spray to cover the vines satisfactorily. Also, the higher the pressure, the more the leaves are moved and turned so that the underneath sides are coated with spray. Spray applied at 200 pounds disturbs the leaves very little and as a result the underneath sides of the leaves are not coated.

When the spray is applied at 600 pounds pressure the cov-

ering is not as good as when applied at 400 even though slightly more spray is put on. This is due to the fact that the cones of spray coming from the nozzles, at 600 pounds, are much narrower than when the pressure is 400 pounds. These narrow cones of spray cover a strip through the center of each row extra well, but the tips of large plants spreading over the ground are missed, which undoubtedly explains the lower yields obtained from the plot sprayed at 600 pounds pressure.

It is interesting to note that the differences in the yields from the plots sprayed at 200, 400 and 600 pounds pressure were much smaller in 1930 than in 1929. During the 1930 season there was very little rainfall to wash the spray off. Applications were made at one week intervals during the hot weather. Evidently, the frequent applications, with very little spray washed off, gave about as effective a covering when the spray was applied at 200 and 600 pounds pressure as at 400 pounds. Rains and good growing conditions came late in 1930, while in 1929 the fall was exceptionally dry, which accounts for the larger yields in 1930.

A great deal of interest has been aroused among potato growers, during the last few years, concerning the best lime to use in making bordeaux mixture for spraying potatoes. Several years ago there was only one satisfactory lime to use and that was quick lime or stone lime. This form of lime consists largely of calcium oxide. When water is added to calcium oxide a chemical reaction takes place in which a considerable amount of heat is generated and calcium hydroxide is formed. Calcium hydroxide is soluble in water to only a slight extent, but it forms a suspension in water which is called milk of lime. When milk of lime and blue vitriol are mixed together the calcium hydroxide and blue vitriol react chemically to form bordeaux mixture.

Of recent years lime companies have been able to manufacture excellent grades of hydrated lime. This form of lime is composed largely of calcium hydroxide, exactly the same material that is formed when stone lime is slaked, except that it contains no excess water. The best grades of hydrated lime will practically all pass through a 300 mesh screen and when they are mixed with water they form a milk of lime the same as is formed when stone lime is slaked. From all appearances such limes should be satisfactory for the preparation of bordeaux mixture. A number of tests have been made at the Experiment Station comparing the value of bordeaux prepared from stone lime and from hydrated lime for potato spraying. The results are given in Table 2.

TABLE 2.—Effect of bordeaux prepared from stone lime and from hydrated lime on potato yields.

| Year and Treatment | Number of applications | Average Yield Bus. per Acre | Increase Due to Spraying |
|---|---|---|---|
| 1926 | | | |
| 4-6-50 (Hydrated lime) | 5 | 244.1 | 71.1 |
| 4-4-50 (Stone lime) | 5 | 233.5 | 60.5 |
| No spray | | 173.0 | |
| 1927 | | | |
| 4-6-50 (Hydrated lime) | 8 | 372.7 | 124.7 |
| 4-4-50 (Stone lime) | 8 | 355.5 | 107.5 |
| No spray | | 248.0 | |
| 1929 | | | |
| 4-6-50 (Hydrated lime) | 9 | 226.1 | 63.3 |
| 4-4-50 (Stone lime) | 9 | 219.5 | 56.7 |
| No spray | | 162.8 | |
| 1930 | | | |
| 4-6-50 (Hydrated lime) | 12 | 293.0 | 125.5 |
| 4-4-50 (Stone lime) | 12 | 291.1 | 123.6 |
| No spray | | 167.5 | |

In addition to the tests conducted at the Experiment Station, cooperative experiments were arranged with three commercial growers in 1930, to compare stone lime and hydrated lime. These growers are considered among the best in Ohio. They have up-to-date spraying equipment and are men who were interested in the experiments and exerted every effort to conduct them properly. The results obtained on the three farms are given in Table 3.

In six of these seven separate experiments, comparing bordeaux mixture prepared from stone lime with that prepared from hydrated lime, the largest yields have been obtained where the hydrated lime was used. The differences are small and certainly in most cases are not significant. There is no doubt, however, but that the bordeaux made with hydrated lime was just as effective as that prepared from stone lime.

Both the hydrated and stone limes used in the tests were obtained from the lime companies at Bellefonte, Pennsylvania. They were high calcium limes and are generally considered the best obtainable for spraying purposes.

TABLE 3.—Effect of bordeaux prepared from stone and hydrated lime on potato yields.

| Location and Treatment | Yield Bus. ped Acre | Difference in Yield Hydrated Lime Over Stone Lime |
|---|---|---|
| Lockheart Farm, Lexington, Ohio | | |
| 4-6-50 (Hydrated lime) | 281.4 | |
| 4-4-50 (Stone lime) | 273.6 | 7.8 |
| Stough Farm, Mansfield, Ohio | | |
| 4-6-50 (Hydrated lime) | 361.1 | |
| 4-4-50 (Stone lime) | 348.5 | 12.6 |
| Parmalee Farm, Painesville, Ohio | | |
| 4-6-50 (Hydrated lime) | 275.3 | |
| 4-4-50 (Stone lime) | 284.6 | —9.3 |

TABLE 4.—Effect of bordeaux prepared from calcium and magnesium lime on potato yields.

| Year and Treatment | Number of Application | Average Yield Bus. per Acre | Difference in Favor of High Calcium Lime |
|---|---|---|---|
| 1929 | | | |
| 4-6-50 (High calcium lime) | 9 | 226.1 | |
| 4-6-50 (High magnesium lime | 9 | 231.7 | —5.6 |
| 1930 | | | |
| 4-6-50 (High calcium lime) | 12 | 293.0 | |
| 4-6-50 (High magnesium lime) | 12 | 284.6 | 8.4 |

In certain sections of the country, Ohio for instance, most of the lime produced is dolomitic lime and contains a high percentage of magnesium. The high calcium lime, such as that used in the tests reported above, contains less than 1 per cent of magnesium oxide. As far as the physical characters are concerned the high magnesium hydrated lime is just as suitable for spraying purposes as the high calcium hydrated lime. Dur-

ing the past two years experiments have been conducted comparing these two types of lime for potato spraying. The results are given in Table 4.

Two years' results are not enough to be considered conclusive. They do indicate, however, that a hydrated lime containing a high percentage of magnesium may be just as satisfactory for the preparation of bordeaux mixture as one that contains practically no magnesium. More tests must be conducted to settle this point.

### Conclusions

Experiments have shown that bordeaux applied at 400 pounds pressure is more effective than when applied at either 200 or 600 pounds. A pressure between 300 and 400 pounds is considered the most effective pressure for potato spraying.

In Ohio good grades of hydrated lime have proved just as good for making bordeaux mixture as stone lime. Hydrated lime is more convenient to use and practically all growers in Ohio are using it with satisfactory results.

Two years' tests with a high magnesium lime indicate that this lime may prove just as satisfactory for the preparation of bordeaux mixture as a high calcium lime.

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## Potato Growing in Bermuda

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The Bermuda Islands are a very small compact archipelago of coral islands seated on the circumference of the crater of an extinct submarine volcano. These islands are 624 miles from Cape Hatteras, the nearest point on the mainland. Contrary to popular belief, they are not tropical, being in about the latitude of Charleston, S. C. The climate may best be characterized as oceanic. Frost never occurs and the night temperatures seldom fall below 50° F. On the other hand, the maximum temperature in the day during the potato season does not often exceed 75° and is frequently well below 70°. The annual rainfall is about 60 inches and is distributed fairly evenly throughout the year.

The total area of the 365 islands is about 20 square miles. As a large part of the area is occupied by houses, hotels, streets and golf courses, and as the majority of the remainder is too rough to be cultivated, it will be seen that the agricultural possibilities of the islands are limited. Potatos constitute the most important crop, being grown on a total area of about 500

acres. Formerly almost the entire crop was exported and cheaper potatoes were imported for eating, but recently a tariff has been put on table potatoes imported into Bermuda and this, in conjunction with the American tariff, has resulted in a decrease in both exports and imports of potatoes. The exported crop in recent years has amounted to 30,000-40,000 barrels. In recent years the price received per barrel has decreased from $14.75 in 1926 to $8.25 in 1929. Most of these potatoes are sold and consumed in New York City, but small amounts sometimes appear in other eastern cities.

A large part of the labor consists of Portuguese from the Azores. Many of these have settled and taken over the land they work. The fields are small (rarely an acre or more) and often irregular in shape and usually consist of depressions in the soft coral rock in which a red soil has accumulated by weathering and washing. The use of dump carts has often supplemented the efforts of nature in this respect. (No automobiles or trucks are allowed on the islands.) Adequate analyses of this soil do not exist. As would be expected from its origin, it is very alkaline in reaction with a pH usually between 7.2 and 8.

Two varieties are grown for export, Bliss Triumphs planted about September 20 and harvested about Christmas, and Garnet Chilis planted in January and harvested in April. Some Triumphs are also planted in the spring, for seed which is used for planting about a month ahead of the usual fall crop. Recently Cobblers have been planted as a third crop for home use, but these are apt to suffer from the dry hot spells of summer.

The original source of the Bliss Triumph seed in recent years has been Nebraska, but this must be grown one year on Long Island in order to have it harvested early enough so it will be out of the dormant period at the regular planting time. The Bliss Triumphs planted in the spring for a seed crop come direct from Nebraska. The Garnet Chili seed comes from Nova Scotia and Prince Edward Island. Much difficulty has been experienced with both of these varieties in obtaining freedom from virus diseases, especially leaf roll. Leaf roll plants in Bermuda usually produce no crop instead of the one-third usually expected in the United States. Recently improved methods of producing the Long Island crop and a better selection of original sources have resulted in improvement.

The seed is cut into pieces of about 1 to 1½ ounces. The soil is prepared by plowing to a depth of five inches several weeks before planting. It is then covered with manure and plowed again. Some growers plow a third time just before planting. The land is smoothed with a harrow. A furrow is opened with the same plow used to fit the land or a double

mould board plow, and the pieces dropped by hand at a depth of 2 to 3 inches and covered with the same plow. The rows are usually 22 inches apart and the seed pieces about 9 inches apart in the row. This requires the use of about 27 bushels of seed per acre.

In the larger fields cultivation is generally by horse cultivators; one level cultivation and a second to hill or "mould" the rows as a protection against wind. In small fields the seed or "sets" are dibbled in by hand, the crop cultivated with hand forks and moulded with hand hoes.

The vines, or "trees" as they are called locally, never grow very large. The only fertilizer used is castor pomace which is usually applied after planting at the rate of about 8 pounds per square rod. Experiments seem to indicate that larger applications are not beneficial and commercial fertilizers have not been found profitable although additional trials of these are now being made. Fungicides are applied either in dust or spray form. Many growers apply no fungicide but the majority spray the potatoes by hand and a considerable number are using hand dusters. Usually not over three applications are made on a crop.

Aside from the virus diseases mentioned, the most serious disease is late blight, and the loss caused by this is more serious in the Garnet crop than in the Triumphs. "Early" blight occurs on both crops, but particularly on the Fall or Triumph crop. In Bermuda the lesions of this disease do not remain small as in the northern states, but enlarge rapidly and involve the whole leaf. The symptoms are often difficult to distinguish from those of late blight. Scab sometimes causes very serious loss. Perhaps low temperatures and abundant rainfall are the factors which hold it in check at other times in the alkaline soil.

Colorado beetles have not been introduced. Leaf hoppers sometimes cause serious damage. Aphids occur but are not very injurious. Fire worms sometimes eat the leaves. Potatoes are often damaged by high winds which break and chafe the leaflets and twist the stalks at the surface of the ground. It is partly for this reason that the fields are kept small with frequent windbreaks. Wind injury seems to be most serious when no rain accompanies the wind, and is apparently aggravated by salt spray blown in from the breakers.

Digging is generally done by hand, usually with a hook or "fork hoe," but sometimes with a fork. The potatoes are sorted into three sizes 1¼ inch to 1½ inch, 1½ inch to 1⅞ inch and 1⅞ inch up. Blemished tubers are removed. About 80 per cent of the crop is usually salable. The potatoes are packed in headed barrels. Experiments are being conducted with a special bushel crate.

The relative importance attached to seed and land by the grower is indicated by the fact that yields are never expressed on a per acre or per rod basis, but rather on a per barrel basis. Five to one is considered an average yield for Garnets and 3½ to 1 is fair for Triumphs. Yields as high as 10 to 1 are obtained from Garnets, but are unusual.

It is probable that the yield rate could be increased markedly if the local factors governing yield were thoroughly understood. The local agricultural station has in fact done much to bring about a better understanding of these factors, but it will readily be apparent that the resources of such a small colony are insufficient to maintain an extensive research program, and much of the research carried out at the larger experiment stations in the United States and Canada is not applicable to the local conditions, which are different from those obtaining anywhere else in the world.

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# Recent Contributions to Potato Breeding and Related Subjects

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R. M. BAILEY, United States Department of Agriculture

The various contributions will be summarized under the following heads: General breeding, mutations, cytology, taxonomy and physiology, and genetic studies.

## 1. General Breeding

Snell (13) in an article in Der Zuchter, surveys the progress of potato breeding in Germany during the past five years. It is pointed out that 170 new varieties have been introduced since 1925. Of these, 64 or more than a third, have yellow flesh. Forty-five of the new introductions are wart resistant.

Schlumberger (12) reports on 14 new German introductions, 12 of which were not previously listed among the 90 wart resistant varieties. The economic value of these new introductions is briefly discussed.

Reddick (10) has reported observations on resistance of certain varieties and species to frost and late blight. S. demissum and some of its hybrids have exhibited resistance to frost, as did also S. Commersonii obtained from Montevideo. S. Com-

mersonii from other sources, S. maglin, S. fendlerii, Green Mountain, Russet Rural, Evergreen and Ekishirazu were killed by frost under similar exposure. Some German varieties withstood frost, and their possible relationship to S. demissum is discussed. The author has found S. demissum also resistant to Phytophthora infestans.

### II. Mutations

Fruwirth (3) has contributed his observations and a discussion concerning mutation in the potato. He discovered an individual having decidedly abnormal leaves in his breeding material, which he attributed to "spontaneous variation." This was further studied and a description of results and the variant's characteristics is given. Fruwirth, in discussing mutation in the potato in general, presents the following points. The potato breeder is interested in mutation from the standpoint of seed certification and from the possibilities of obtaining new varietal forms from morphological variation and the possibility of securing improvement through selection in vegetative lines. The author states that the rate of mutation is different among varieties; that a large proportion of the mutations which he has observed are morphological but that there may be also internal changes in conjunction or singly. He also states that mutations may occur in all portions of the potato plant and that the maintenance of a mutation is reversion to a previous form. New type secondary mutations are more rare. It is pointed out that vegetative mutations may or may not breed true, depending on the tissue involved. Those that do not, he considers periclinal chimeras. Breeding behavior will indicate their nature. He considers the origin of mutations as due (1) to unequal cell division, or (2) to abnormal laying down of tissues.

### III. Cytology, taxonomy and physiology

Rybin (11) reports some interesting observations on the cytology and taxonomy of the potato. Rybin found 48 (diploid) chromosomes in Irish Cobbler, Early Green Mountain, Early Rose, Epicure, Furstenkrone. This corroborates the observations of other recent workers. Reduction division was found to be quite regular. Cytological examination of forms indigenous to South America, showed groups within the section tuberarium having diploid chromosome numbers of 24, 36, 48, and 72. The diploid chromosome number of the polymorphous species of S. medians, S. Maglia, S. Commersonii, and S. coyoacanum is 36. In two of the species, S. medians and S. coyoacanum, irregular reduction division was found. Their preservation is explained by their capacity for vegetative propagation.

There were investigated 236 specimens of the cultivated potato

collected in Mexico, Columbia, Guatemala, Peru and Chile (mainland and the island Chiloe). In the region of Peru—Bolivia—potatoes characterized by 24, 36, and 48 diploid chromosomes were found. The irregular reduction division in the 36 chromosomes were found. The irregular reduction division in the 36 chromosome group and their morphological characteristics leads to the belief that all 36 chromosome potatos are hybrids. Thirty-six samples of potatoes from the island of Chiloe showed the somatic number of chromosomes to be 48, i. e. the same as in commercial varieties of Europe and North America. This is considered weighty proof that the European and North American forms have originated from Chili, since the remaining 48 chromosome potatoes of South America, already investigated morphologically, are not likely, according to Bukasov, to have taken any part in the formation of the European and North American commercial varieties.

Juzepczuk, S. W. and Bukasov, S. M. (6) point out the large number of species of the tuber-bearing section of the genus Solanum which occur in Central and South America. The authors state that "The different forms of the collective Solanum tuberosum differ from each other and from some wild growing tuberiferous species of Solanum, considered by some writers as independent species, by sharper and more important characters than those which constitute the difference between these species." These facts together with the strictly local character of the native potatoes of America, suggests that they have originated from several wild growing species, which moreover were often disconnected geographically.

Maschmeier (7) studied the applicability of serological diagnosis to distinguish between cultivated potato varieties. Juice extractions of healthy and diseased plants of the same variety gave the same biological reaction. S. tuberosum, S. chaoense, S. Commersonii, S. nigrum, and S. lycopersicum gave different reactions.

Kesseler (5) has reported on the morphology and physiological behavior of potato pollen. Germination and growth of pollen was studied in vitro and vivo and under different environmental conditions. Some of the more outstanding observations reported follow: (1) The size and shape of pollen grains is not indicative of its capacity to germinate, (2) Viable potato pollen can be differentiated from the sterile by the aid of certain stains, (3) A satisfactory germination medium consists of agar 6%, cane sugar 20%, and diastose .002%, (4) Temperature was an important factor in influencing germination; the optimum is about 26°C, (5) The highest percentage of germination obtained was 46.9%, (6) Potato pollen remained viable for ten days under

the best of conditions, (7) A wide growth differential of the pollen tube exisis after germination, some grains exhibiting very little tube growth, whereas others grow to complete fertilization.

## IV. Genetics

McIntosh (8) in a recent article points out the following color associations with the skin color varieties. He suggests that they might be of value in classification and identification.

1. Skin colored varieties invariably have colored flowers.
2. The following characters are indicative of varieties having colored tuber skin.
   a. Highly colored pedicel abscission layer (cork ring).
   b. Colored corolla base.
   c. Colored base of berry.
   d. Colored roots.
   e. Colored vascular bundles in stem.
3. Characters frequently associated with colored skin.
   a. Colored sprout rootlets.
   b. Deep coloring at point of insertion of peduncle branches, i. e. axials of inflorescence branches.
   c. Highly colored leaf and petiole bases.

Black (2) studied the progeny of varietal crosses. He concludes that four factors are involved in suffused skin tuber color. In addition to the P, D, and R factors reported by previous investigators, an inhibiting factor H is suggested, which is incompletely dormant to D, and regulates intensity of pigmentation. The author does not differentiate between skin and cortical tuber color, classifying both types as skin color.

In crosses between white fleshed varieties, yellow and pale yellow fleshed individuals were obtained in addition to white fleshed individuals. Crosses between round shaped varieties gave progenies with oval, kidney, long and round types, which indicated that more than one factor was involved in tuber shape. Shallow, medium and deep-eyed varieties appeared to be heterozygous.

Huber (4) obtained yellow fleshed varieties by inter-crossing those having white flesh. Huber also found that eye depth depends upon the complimentary action of two factors.

Muller (9) in a recent article has discussed Phytophthora resistance in the potato. It is pointed out the plant exhibits high resistance in the early stage of growth, whereas growth produced later is more susceptible. A positive correlation exists between

maturity of the variety and date of appearance of late blight symptoms. In general, early varieties succumb first, but other factors may influence time of outbreak. Plant breeders have attempted to produce Phytophthora resistant varieties for a long period. The author points out that a study of 800 varieties, also others mentioned as highly resistant in the literature, including Japanese, establish no variety as resistant. Evidence exists of resistance in some of the wild forms, and the author has secured resistant individuals by crossing these forms with cultivated varieties. By successfully back-crossing hybrid forms to cultivated varieties, individuals have been obtained which are close to the cultivated types and have the resistance of the wild races.

Bartosch (1) has reported a biometrical study of the inheritance of tuber shape in crosses and selfed progenies. The results showed that the previously advocated hypothesis of simple monohybrid inheritance for tuber shape is not satisfactory. A multiple factor hypothesis offers a satisfactory explanation. The inheritance can be explained on the basis of three or four factor pairs which affect to a greater or lesser extent the growth of the tuber in length and thickness.

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# The Effects of Seed Treatment on Black-Leg

JOHN TUCKER, Central Experimental Farm, Ottawa, Canada.

The treatment of seed potatoes is now a routine practice followed by many growers. It is intended principally as a control measure in reducing the amount of common scab, rhizoctonia and blackleg diseases in the potato crop.

SEED TREATMENT AND BLACKLEG INFECTION, 1930

| District | No Treatment | | | Bichloride | | | Formalin | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total fields | Number of fields infected | Average per cent infection | Total fields | Number of fields infected | Average per cent infection | Total fields | Number of fields infected | Average per cent infection |
| No. 1 | 2519 | 611 | 0.84 | 2517 | 391 | 0.61 | 32 | 7 | 0.71 |
| No. 2 | 187 | 21 | 0.79 | ..... | ..... | ..... | 180 | 12 | 0.92 |
| No. 3 | 508 | 291 | 0.48 | 5 | 3 | 0.1 | 37 | 18 | 0.4 |
| No. 4 | 548 | 300 | 2.36 | 3 | ..... | ..... | 1297 | 462 | 1.27 |
| No. 5 | 217 | 155 | 1.02 | 215 | 133 | 0.93 | 116 | 80 | .97 |
| No. 6 | 86 | 40 | 1.98 | 7 | 2 | 0.83 | ..... | ..... | ..... |
| No. 7 | 90 | 28 | 2.05 | 8 | 1 | 0.67 | 38 | 8 | 1.29 |
| No. 8 | 47 | 13 | 1.18 | 7 | ..... | ..... | 91 | 14 | 2.07 |
| No. 9 | 91 | 28 | 1.66 | 144 | 23 | 0.69 | 29 | 5 | 1.15 |
| Total | 4293 | 1487 | 1.37 | 2906 | 553 | .48 | 1820 | 606 | 1.10 |

AVERAGE LOSS OF CROP

| | |
|---|---|
| 4,293 growers did not treat | 0.47% |
| 2,906 growers treated with Bichloride | 0.09% |
| 1,820 growers treated with Formalin | 0.37% |

For the purpose of securing some information on the actual results in controlling blackleg that are being obtained by growers with their present methods of seed treatments, as practiced on the farms under commercial conditions, it was decided to assemble all available data specifying the treatment used and the percentages of blackleg disease present. The growers supplied the former information, and the field inspectors employed on seed certification work, the latter.

There were 9,019 good reports used in compiling the following data, and these reports cover representative potato growing areas in every province.

## SUMMARY

Seed treatments, as at present applied on farms, reduce but do not altogether control Black Leg.

Formalin treatment is of small benefit in Black Leg control.

Bichloride is more effective than Formalin in Black Leg control.

The results, as compiled from field records during the three years 1928-1930, are fairly uniform as the following condensed table shows:

SEED TREATMENT AND BLACKLEG INFECTION, 1928-1930

| Treatments | Total number of fields | | | Average per cent blackleg in infected fields | | | Average per cent loss of crop, total fields | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1928 | 1929 | 1930 | 1928 | 1929 | 1930 | 1928 | 1929 | 1930 |
| No treatment | 3,506 | 4,690 | 4,293 | 1.2 | 0.93 | 1.37 | 0.57 | 0.42 | 0.47 |
| Bichloride | 2,858 | 2,702 | 2,906 | 0.73 | 0.72 | 0.48 | 0.21 | .20 | 0.09 |
| Formalin | 946 | 1,001 | 1,820 | 0.94 | 0.99 | 1.10 | 0.32 | .35 | 0.37 |

# Crop and Market News

## THE EARLY POTATO SITUATION

(A radio-talk given over Station WRC, Washington, D. C., on Monday, May 18, by Paul Froehlich, Bureau of Agricultural Economics)

Well, folks, let us consider today the early potato situation from both crop and market standpoints. The potato is such an humble, everyday article of food that you may wonder why we devote an entire radio talk to this one crop. But, if pota-

toes were removed from the menu of the American public, their absence would surely emphasize their importance.

In spite of relatively low prices for old potatoes during the winter and a liberal supply of this crop since last fall, growers in the earliest shipping States of the South increased their plantings about one-eighth above those of last season. In general, the yields are proving to be much better this spring. The northern part of Florida has been digging 50% more potatoes from each acre than last year, and other States which have just begun shipping also indicate improved yields. Growers in the lower Rio Grande Valley of Texas had considerable losses from frost and blight, and the crop was very short in that section. Nevertheless, for the eight earliest States together, the official reports indicate a commercial crop of 15,830,000 bushels, or an increase of one-fifth over last year's production.

The active Florida season will soon be finished. Eagle Lake district of Texas is now getting under way and expects to make exceptionally large shipments. Movement of Bliss Triumph potatoes has already become very heavy in Alabama and Louisiana. Those two States have much larger crops than in any recent year. Production in South Carolina is expected to be the heaviest since 1928, and that State will begin shipping this week, along with the bumper crop from Georgia.

Now let us take a forward look and see what may happen during the next two months, provided the weather remains favorable: Out in Oklahoma, a severe April freeze and an excess of rainfall damaged and delayed the early potato crop rather seriously. The Kansas crop seems to have recovered from the adverse weather conditions of a month ago. Potatoes in Missouri are not doing quite so well, but the Louisville section of Kentucky expects a good crop this year. Along the Atlantic Coast, there is every indication of a good-sized crop in North Carolina, although the shipping season may be a little late. Virginia, as you all know, is the largest shipper of midseason potatoes, often marketing 20,000 carloads or more during the two months of June and July. The slight reduction of plantings in Virginia this year may help to save the summer market prices from undue depression. North Carolina and Arkansas report considerable increases of acreage over those of last season, but Maryland shows a slight decrease in commercial acreage. In the entire group of six second-early States, the plantings are estimated at 151,000 acres, or only 1½% more than their 1930 acreage. Of this total Virginia claims almost three-fifths. To summarize the situation, it now looks as if there will be a great abundance of early potatoes this spring and summer, with supplies from now until mid-June

much larger than last spring but with a slight decrease in the excess after that time.

Just a few words about shipments and prices: In spite of the heavy shipments from Florida, carlot movement of new potatoes this season to date has not equalled that of a year ago, because of the lighter crop in Texas and the delayed season in Alabama and Louisiana. But the carlot figures are expected to catch up very soon, and before long they probably will exceed last year's corresponding total. Recent forwardings of new stock have averaged 500 cars daily, and old potatoes are still moving at the rate of 450 cars each day. The most noticeable feature of the potato situation this past winter and spring has been a lack of speculative demand on the part of large receivers in city markets. And this same lack of demand is being keenly felt at the present time. Furthermore, the general level of food prices is relatively low. The best potatoes are returning only $2.50 per barrel in northern Florida, compared with about $6.50 a year ago. Shippers in southern Alabama are getting only $1.15 per sack of 100 pounds. At the same time last spring the price was around $3. In view of these conditions, it behooves growers and shippers everywhere to put up the best possible grades and packs, and to keep the poorer potatoes on the farm, if they cannot be sold separately.

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### Production Forecast for Early States—May 13

Commercial production of early potatoes in Florida and the Lower Rio Grande Valley of Texas is now expected to total 3,918,000 bushels or only 2 per cent less than in 1930. Yields are exceeding earlier expectations in the Hastings and La Crosse sections in Florida. In six other earliest shipping states and in other sections of Texas, the production is forecast at 11,703,000 bushels compared with 9,141,000 bushels last year. In this latter group, the yields are expected to be better than last year, but the larger crop anticipated is principally due to a 24 per cent increase in acreage. For the eight early states reported to date, May 1 reports indicate that commercial production will be one-fifth larger than last year on an acreage 13 per cent larger.

### Commercial Acreage In Second Early States

The acreage planted in the second early states appears to be slightly larger than the 1930 acreage or about as indicated by the reported intentions of growers several months ago. Further investigations will be made of the planted acreage in connection with the forecast of production to be issued about May 23.

KANSAS: Potatoes were planted unusually early and many

fields were up and suffered a setback by the frosts of late April. The damage was only temporary, however, and most fields still hold promise of good stands. Present indications are that a larger acreage was planted this year. Conditions about 80 per cent. (May 9).

MISSOURI: The condition of the crop is not so good as expected because rains in March extended the planting season over a longer period than was expected. Also the fields have become grassy and weedy. No complaint of poor stand is noticed. Potatoes in the St. Louis district have had a fairly good season, although a bit short of moisture. Around Kansas City sufficient moisture came, but weather has been somewhat too cool. (May 2).

NEW JERSEY: Planting of commercial early white potatoes has been delayed somewhat by cold weather, and the greater part of the crop is not up yet. (May 6).

NORTH CAROLINA: The crop is ten days late, but the growth is good and healthy and the stands are unusually good. Moisture conditions have been favorable. While the top growth has been backward, the root systems have been developing nicely in a well prepared soil. (May 4).

SOUTH CAROLINA: The South Carolina potato crop is in good condition. Growers report the need of rain, which event would add five more barrels to the average. Vines are blooming, and digging will begin approximately the 15th of May. While most of the potatoes in South Carolina are of the Irish Cobbler variety, there is quite an acreage of Green Mountains planted again this year. (May 2).

TEXAS: Rains late in April were beneficial to the Irish potato crop. The Eagle Lake-Sugerland-Wharton area should start harvesting in a light way beginning the week of May 4th. General movement should be under way by the 11th with the probable peak about the week of May 18th, however, the harvesting will extend over a much longer period than usual due to a considerable portion of the crop having been planted late. Stands are thin in some instances and some plants have been damaged by frosts, but on the whole prospects are for a fair yield. The Lower Valley crop was reported to be slightly over half finished on May 1. In other areas of the state the crop is fairly satisfactory, but averages somewhat late. Condition in the Lower Valley was 54 per cent on May 1 and 78 per cent in other areas, the weighted average condition for the state being 68 per cent compared with 59 per cent a month ago. (May 2).

VIRGINIA: Plantings of the commercial crop in February were much heavier than usual due to warm weather. Cold weather in March retarded growth, and it is believed that if the

growing conditions during March had been favorable the crop would have matured earlier than usual, partly due to early plantings and the heavy plantings of shipped-in seed which matures a little earlier than home grown seed. It now looks as if the maturity should be about normal. Outside of the commercial sections, there are indications of quite an increase in acreage, especially in the tobacco, cotton and peanut areas. Potatoes have just commenced to come up in most sections of the state. (May 5).

## Notes

### CONNECTICUT

A potato field tour will be held in Connecticut next July 25 for inspection of seed strain tests, spraying tests, cultural machinery and fertilizer experiments provided plans recently made by the state potato committee materialize.

Last winter a questionnaire was mailed out to potato growers of the state to determine the amount of interest that exists in tours and field days and the returns were sufficiently favorable to have a tour that the committee decided to arrange the most popular demonstrations on farms in New Haven, Hartford and Tolland Counties so that they could be inspected in one day.

The seed strain test is an old one and has been declared by many experts to be obsolete, yet it found as popular demand among the growers as most any other type of demonstration.

There is considerable argument in Connecticut over the desirable strength for bordeaux mixture, some of the growers claiming a 8-8-50 is very superior to a 4-4-50 in the control of flea bettle and demonstrations will be arranged to show the comparative merits of these two strengths of bordeaux as well as the advantage or disadvantage of spraying the plants as soon as they reach three or four inches in height rather than wait until they are a foot high or more.

A series of fertilizer experiments have been in progress on the farm of Frank V. Williams, Buckland, under the direction of B. A. Brown, Connecticut Agricultural College for several years past and it is expected that this experiment will be included in the tour. The experiment is designed to show the comparative analysis of large and small amounts of fertilizer as well as different strengths of mixture.

Connecticut growers are very much interested in producing a superior quality of potato. It being a recognized fact that Connecticut potatoes are the equal of any grown in the east.

The growers are now striving to improve the quality of their potatoes to the point that they will compete with the best of the arid grown baking potatoes and in this connection five tests will be run where the amount of potash will be doubled bringing the treatment up to 2000 pounds of 5-8-14 as compared with 2000 pounds of 5-8-7. The tubers from these plots will then be tested for cooking qualities at the Connecticut Agricultural College next fall and winter.

The state committee in charge of this field day is composed of B. A. Brown, A. E. Wilkinson, C. D. Lewis, J. S. Owens and P. L. Putnam.

## BORDEAUX MIXTURE*

Do you know all about commercial Bordeaux mixtures, and are you sure you know how to calculate their values?

"Bordeaux mixture is at present the only reliable preventive for certain diseases of plants and must be used despite the present high price of copper sulphate.

"Since commercial Bordeaux mixtures vary widely in copper content it is necessary for the grower to know their strength in terms of the amount of equivalent copper sulphate in 50 gallons when diluted.

"This can be easily calculated by the method described in this bulletin or can be approximately determined without calculation by reference to Tables I and II.

"After the strength of the product is known, the relative money value of its ingredients can be easily calculated.

"Physical properties, such as adhesiveness, texture, spreading quality, and rate of settling, also are important factors in determining the efficiency of Bordeaux mixtures.

"The grower should regard spraying as an insurance and preventive and should always be prepared for an epidemic of the disease he expects to combat. If he wishes to insure good control, he should, therefore, use a preparation equivalent to the standard Bordeaux mixture recommended for that purpose."

The above information was taken from Farmers' Bulletin 994, U. S. Department of Agriculture, entitled "Commercial Mixtures." Copies of this bulletin may be obtained from Washington, D. C., or from the writer.

Along with calculating the values of Bordeaux, it may be well to study the bulletin entitled, "Influences of Form and Proportion of Lime Used and of Method of Mixing on the Resulting Bordeaux Mixtures"—a reprint from the Journal of Agricultural Research, Vol. 34, No. 7, U. S. Dept. of Agriculture. This bulletin will give just the information needed. A summary follows:

*From a circular letter issued by the Connecticut Agricultural College Extension Service.

"Four forms of lime (limewater, chemically preciptated lime, milk of lime, and commercial hydrated lime) were employed in preparing Bordeaux and allied mixtures. The activity varies directly as the degree of dispersion and decreases in the order named.

"The best ratios of active lime in the several forms to copper sulphate, as judged by suspension, are as follows:

Limewater—0.538 gm., 100 c. c.
Precipitated lime—4 pounds, 1.5 pounds, 50 gallons.
Milk of lime—4 pounds, 2.00 or 2.25 pounds, 50 gallons.
Hydrated lime—4 pounds, 2.00 pounds, 50 gallons.

"The best method of mixing similarly judged, is by pouring dilute copper into concentrated lime or the two simultaneously into a third receptacle.

"Some of the better grades of hydrated lime are promising substitutes for milk of lime but require soaking before being used."

On this same point a bulletin from the Massachusetts Agricultural Experiment Station, Amherst, Massachusetts, Contribution No. 64, on the subject of "Chemical Hydrated Lime for the Preparation of Bordeaux Mixture" is interesting and valuable. A portion of the bulletin is as follows:

"The chief difficulty in preparing Bordeaux mixture lies in the proper slaking of the lime. The suspension of the resulting calcium hydroxide and its activity or speed of reaction vary with the degree of dispersion or size of particles, as has been shown by different investigators. Unless the lime is thoroughly dispersed and free from large aggregates, the physical properties of the subsequent Bordeaux will be seriously impared and its efficiency as a fungicide reduced. The removal of coarse particles of lime and of insoluble matter from the milk of lime, by sieving or screening through double thickness of cheesecloth, is advisable in all cases but can not convert a poorly dispersed lime into a highly active product, to say nothing of the waste of material involved.

"Everyone will concede that the hand-slaking of lime is hard to control, is laborious, and time-consuming, and that the substitution of commercial hydrated lime promises better and more uniform results provided a suitable product can be obtained at a reasonable cost. Agricultural lime is poorly adapted for the purpose; and ordinary plasterers' or finishing lime, containing 55 to 60 per cent active calcium hydroxide, carries too much inert material to be entirely satisfactory, although if soaked in water over night before use, it yields a Bordeaux of good suspension.

"Chemical hydrated lime prepared from selected, high calcium limestone is now produced extensively in various sections of the country and is well suited for the preparation of

Bordeaux. In some instances the limestone employed contains substantially 99 per cent of calcium carbonate and is burned in steel kilns, fired by wood, coal, gas or oil.

"The quality of chemical hydrated lime depends on the purity of the deposit, the care exercised in mining and selection of the rock, and the chemical control of the manufacturing process."

A. E. WILKINSON,
Ext. Spec. in Veg. Gardening.

## Review of Recent Literature

**Whitehead, T.** Field trials with "Golden Wonder" and "King Edward VII" potatoes.—Scottish Jour. Agr. 14: 193-199, 1931.

The object of the trials as explained by the author was to test the cropping power of an improved strain of Golden Wonder against that of King Edward VII with a view to determining whether the English grower would be justified in continuing to plant commercial seed of the non-immune variety King Edward VII in preference to an improved strain of the immune Golden Wonder. The result of the test indicated a difference in yield of 14 cwt. per acre in favor of commercial stock of the King Edward VII variety.

Comparison of stock seed of each of the two varieties resulted in an increased yield of 67.5 bushels in favor of King Edward VII.

The greatest point of interest, however, from the standpoint of the relative merits of improved and commercial seed stocks of the Golden Wonder was brought out in a comparison of the yields produced. The commercial strain yielded at the rate of 352.8 bushels per acre while the improved stock yielded 406.9 bushels.

—W. STUART.

**Jensen, Harry J. and Morris, O. M.** Potato Growing in the Irrigated Districts of Washington. Washington Agr. Exp. Sta. Bul. 246: 1-30, January 1931.

Among the opening statements in this bulletin are two of general interest. The proportion of the total acreage grown in Washington which is produced under irrigation is annually increasing. Potato grading is now compulsory in this state.

Much of the bulletin is devoted to cultural recommendations. In addition the authors add the results of recent experiments on green manure crops for potatoes, plant spacing, rate of plant growth, irrigation practice, and tuber injury from exposure to extreme temperatures at harvest time.

GREEN MANURE CROPS: Rye, wheat, vetch and manure were compared in respect to their manurial value as influencing yield of potatoes. Seedings of the green manure crops were made October 20, and the growth plowed under the following May. Wheat made a higher growth than rye and rye higher than vetch. The yields per acre of potatoes after rye and wheat were 5.7 and 6.9 tons while those after vetch and manure were 1.05 and 10.3 tons respectively. Vetch or some other legume is recommended in preference to rye or wheat.

PLANT SPACING: Plant spacings of 6, 12, 18 and 24 inches in 33-inch rows under irrigation were compared in 1925, 1926, 1927 and 1929. Both total yield and yield of U. S. No. 1 grade were decreased as the distance between plants increased. For the above spacings the U. S. No. 1 yields averaged 6.07, 5.16, 4.60 and 3.34 tons per acre respectively. Similarly, the total yields averaged 10.18, 9.26, 8.68 and 7.76 tons respectively. The closer spacings are recommended except under conditions of low fertility. Uniformity and quality of tubers were best under the closer spacings.

RATE OF GROWTH: Fifty hill lots of plants from a planting made May 18 were dug at weekly intervals from July 14 to October 1 for rate of growth studies. The data show that most of the tubers were formed 71 days after planting, the approximate maximum number being formed August 6 or 78 days after planting. Although little new top growth occurred after August 6, weight per tuber and per hill continued to incease up to October 1. The most rapid rate of increase in weight per hill occurred about 100 days after planting.

IRRIGATION PRACTICE: Variation in amount of water applied before and after blossoming of the plants was studied in relation to yield and percentage of U. S. No. 1 potatoes. The authors conclude that water supply is not important so long as it is sufficient to prevent any check in growth rate. During the three-year period, 1927-1929, the data indicate that heavy application after the blooming period is more productive of quality and yield than heavy application before blossoming.

HEAT EXPOSURE OF TUBERS AT HARVEST: Potato tubers dug immature in July and left exposed to the sun for varying lengths of time showed surface flesh injury quite in proportion to the air temperature and the duration of exposure. One hour exposure to temperatures of 77° to 89° F. resulted in no injury. On the contrary, exposure from 8:00 a. m. to 5:00 p. m. on hot days resulted in complete breakdown after 10 days in cellar storage. One hour exposure at a temperature of 91° F. resulted in epidermal discoloration which showed after 10 days in storage.

—E. V. HARDENBURG.

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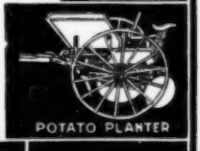

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